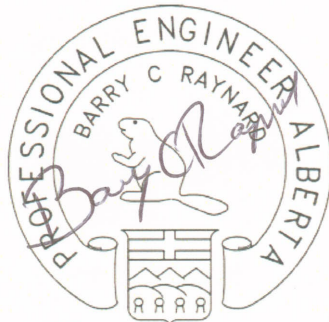


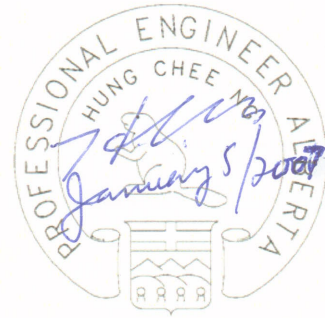
Corporate Authorization

This document entitled “2005 Wastewater System Master Plan - Grande Prairie-Clairmont Corridor Servicing Strategy - Final Report” was prepared by ISL Engineering and Land Services Ltd.



January 5, 2007

Barry Raynard
M. Eng., P.Eng.
Senior Water Resource Engineer



Herman H. C. Ng
M.A.Sc., P.Eng.
Project Manager

PERMIT TO PRACTICE

ISL Engineering and Land Services Ltd.

Signature

Date

PERMIT NUMBER: P 4741

The Association of Professional Engineers, Geologists
and Geophysicists of Alberta

Acknowledgements

The project consultants gratefully acknowledge the following individuals for their valuable contribution to this study:

County of Grande Prairie No. 1

Herb Pfau, C.P.W.S.
Ed M. Piebiak, P. Eng.
Derek Basnett, C.E.T.

Aquatera Utilities Inc.

Tim Lau, P. Eng.
Evan Albinati, C.E.T.
Lynne Coulter

Corvus Business Advisors

Tom Cooper, B. Comm., CMA

ISL

Herman Ng, M.A.Sc., P. Eng.
Barry Raynard, M.Eng., P.Eng.
Dave McRae, M.E.Des., M.C.I.P.
Mohammad Tariq, M.Sc., P. Eng.
Geoffrey Schulmeister, E.I.T.
Sean Novak, E.I.T.
Ralph Schimanke, C.E.T.
Therese Collin, C.E.T.

Executive Summary

The study area consists of approximately 18.5 sections of land extending from 132 Avenue northerly to Mercer Hill between Range Road 55 and Range Road 63 except Section 31-72-5-6 and Section 34-72-6-6. Out of the 18.5 sections of land, five quarter sections are located in the Grande Prairie City limit. The purpose of preparing of a wastewater system Master Plan is to develop efficient and cost effective servicing strategies as a planning tool to accommodate the tremendous growth in the Grande Prairie-Clairmont Corridor in an orderly manner.

Nine area structure plans were previously completed which include West Clairmont, Kehr Althen, Althen Corner, Balisky Hodges, Crossroads South Phase 1 and 2, Crossroads North Phase 1 and Lakeside.

Future industrial and commercial development in the study area is estimated to be approximately 2,121 hectares. The projected annual consumption rate is approximately 103 ha.

The current population of the study area is approximately 1,700 people and the projected ultimate population is 52,425 people. The projection was calculated on the basis of 45 persons/gross ha for urban residential development and 27 persons/gross ha for rural estates.

Design Criteria

A review was conducted on the current design criteria. The following new design criteria were recommended:

- General commercial development wastewater flow to be 10,000 L/ha/day
- School wastewater flow to be 15,000 L/ha/day
- Low pressure sewer system
- Peaking factor for commercial and industrial developments = $2 < 6.659(Q_{avg})^{-0.168} < 5$
- Required design flow = Peak Flow/0.864
- Infiltration/Inflow at sag manhole = 0.4L/s
- Population density per ha to be RR 1 = 36, RR 2 = 45, RR 3 = 45, RR 4 = 51, RE = 27 and MHC = 51

Wastewater Lagoon

The capacity of the facultative and storage cells of the existing lagoon is almost at the design capacity of the current wastewater flow from the study area. Upgrading of the existing lagoon will be required immediately.

Investigation of a more suitable wastewater disposal system for the study area was carried out and the following options were investigated:

- Expand the existing lagoon
- Construct an aerated lagoon with six month storage
- Construct a conventional wastewater treatment plant with six month storage
- Construct an advanced wastewater treatment plant complete with nutrient removal and disinfection systems
- Connect into the future City of Grande Prairie 116 Street sanitary trunk sewer

The investigation concluded that discharging the effluent from the lagoon into the 116 Street sanitary trunk sewer is the most cost effective option. The implementation cost is approximately \$21.5 M excluding the cost for the improvement of Aquatera Wastewater Treatment Plant.

It was noted that the wastewater flow for the full build-out condition of the study area is very high. This is mainly due to the large lot size of the industrial and commercial developments. The development of most of these areas will be implemented in stages. For this reason, approaches were considered to determine a reasonable wastewater flow for the staged implementation of the lagoon improvements. For all various growth contours, the full amount of wastewater flow from residential developments will be considered. With respect to the commercial and industrial developments, for the initial five years, one sixth of the flow will be used. For all other growth contours, one third of the flow will be used for the assessment.

Hydraulic Analysis

A wastewater model was developed for the existing system using XP-SWMM Version 9.50 software, the City of Grande Prairie diurnal curves and infiltration data, and rainfall events. The accuracy of the model is unknown because flow monitoring data was not available to carry out a calibration. It is recommended that flow monitoring be carried out for future model calibration.

The wastewater model revealed that the existing wastewater collection system will not require improvements, however, the wastewater lagoon which will require upgrading immediately.

Ultimate Servicing

The preferred ultimate servicing options for the basins are described as follows. The drainage basin is shown in Figure 8.1.2.

- Area 1 and 22: Crossroads South Phase 2, McRae and Part of Sec 6-72-5-6 and SE ¼ 1-72-6-6
This area will be serviced into the future lift station in the Crossroads North Phase 2 subdivision.
- Area 2 and 21: Part of Sec 6-72-5-6
The three servicing options considered include one servicing option to service Area 2 and Area 21 independently into the future Crossroads Lift Station and the 88 Street trunk sewers. The other two options are to service both areas together into either into the future Crossroads Lift Station or the 88 Street trunk sewers. The preferred option is to service both areas into the 88 Street trunk sewers (conditional to right-of-way availability).
- Area 3: South West Corner of Crossroads South Phase 1 and McRae
Servicing the area through Crossroads Phase 1 and Phase 2 were investigated. The option through Phase 2 would be more cost effective and is therefore, the preferred option (conditional to right-of-way availability).
- Area 4: Land between the Railway Tracks and Highway 2
The serving options considered include connecting into the existing Crossroads Lift Station and the Four Mile Corner Lift Station. The Crossroad Lift Station is the

preferred option because the Althen Corner local trunk does not have the capacity to accommodate the flow from this basin.

- **Area 5: Balisky-Hodges**
Four servicing options were investigated. Two of these options are to service this area into the Aquatera existing sanitary trunk sewers (within the City of Grande Prairie) which are either cost prohibitive or temporary. The preferred option is to service this area into the Four Mile Corner lift station by gravity sewers.
- **Area 6: West Clairmont, Kehr-Althen and Althen Corner and Balisky Hodges North**
This area will be serviced by the Four Mile Corner Lift Station and a forcemain into the forcemain on 100 Avenue. Both the existing lift station and forcemain will require upgrading to accommodate ultimate development in this area.
- **Area 7: SW ¼ 1-72-6-6 and SE ¼ 2-72-6-6**
This area will be drained into the Aquatera sanitary sewers in the City of Grande Prairie.
- **Area 8: West Clairmont - West of Highway 2**
This area can be serviced into the existing 375 mm diameter sanitary sewer crossing Highway 2 at Township Road 723.
- **Area 9: West Clairmont - South of Township Road 724 and West of Highway 2**
This area can be serviced into the existing 200 mm diameter sanitary sewer on 100 Avenue immediately east of Highway 2 or to the local sewer in Northgate Industrial Park approximate 150 m west of the Northgate L.S. Monitoring the flow in the area will be require for scheduling the upgrading of the downstream system.
- **Area 10: West Clairmont - South of Township Road 714 and East of Range Road 62**
There are three drainage servicing options. The preferred option for this area is to connect directly to a new gravity sewer which will drain into a future lift station at the southwest corner of the SE ¼ Sec 27-72-6-6.
- **Area 11: West Clairmont Phase 2 and 116 Street North**
This area will be serviced by Lift Station #10 which discharges the effluent through a forcemain into the lagoon.
- **Area 12: 116 Street South and 116 Street North**
This area will be serviced by a regional lift station to be constructed at the south west corner of the SW ¼ sec of 3-71-6-6 and a forcemain along Range Road 63 to a gravity trunk at the topographic high about 1.5 km south of Township Road 724 (100 Avenue).
- **Area 13: Eastern Part of Lakeside**
This area can either be serviced by a lift station and a forcemain or a deep gravity sewer discharging into the Lakeside trunk sewer and then into a regional lift station at the north west corner of NW ¼ sec 24-72-5-6. The deep gravity sewer is the preferred option.

- Area 14: Western Part of Lakeside
This area will be serviced by a gravity trunk sewer northerly to the future regional lift station at the north west corner of NW ¼ sec 24-72-5-6.
- Area 15: Crossroads North Phase 1 and 2
Among the three servicing options investigated, two of them are more favourable.

The first favourable option is to use the existing Highway 43 Crossroads Lift Station, as shown in Figure 8.4.1, to service Phase 1 of the Crossroads North and South subdivisions and construct a new lift station #6 north of Highway 43 to service the Phase 2 of the Crossroads North and South subdivision. The new lift station will discharge into either the Lakeside or Northgate sewer system at Node 161. For this option, the existing 525 mm diameter sanitary trunk sewer at Node 160A will require upgrading as well.

The second favourable option is to abandon the existing Crossroads Lift Station and construct a regional lift station to service the entire drainage basin. To implement the preferred option, further investigation is required with respect to the cost of upgrading the existing lift station to service both the Phase 1 Crossroads North and South Subdivisions and the reduction in the operation and maintenance costs for a single lift station.

- Area 16: Northgate Industrial and West Part of Crossroads Phase 1
This area is currently serviced into the existing 525 mm diameter sanitary sewer.
- Area 17, 18 and 23: Clairmont and Clairmont Heights
The preferred servicing option for this area is to service by gravity sewer to the existing 525 mm diameter sewer with Lift Station No. 2 eliminated and a relief sewer constructed from Lift Station No. 2 to a new regional lift station at the north end of Lakeside.
- Area 19 Eastern part of the NW City Fringe
This drainage basin can be connected into the existing sanitary trunk sewer on 108 Street at 117 Avenue.
- Area 20: Western part of the NW City Fringe
The preferred drainage option is to service this area into the future regional station along Range Road 63 at the south west corner of the SW ¼ Sec 3-72-6-6.
- Area 24: Sec 35-72-6-6, Sec 26-72-6-6 and SE ¼ Sec 27-72-6-6 (Ferguson lake)
This area will be serviced by gravity sewers into a future lift station at the south west corner of SW ¼ Sec 27-72-6-6.

The issues which should be considered in finalizing the ultimate options for all drainage areas, include the Crossroads North Trunk upgrading and the size of the Lakeside Trunk, Lakeside North Regional Lift Station and the outfall to the wastewater lagoon. The recommended ultimate servicing concept is shown in Figure 8.4.1.

Staging and Interim Servicing Plan

The hydraulic analysis revealed the following upgrading requirements:

- Upgrade the Crossroads Lift Station in approximately five years on the basis of a flow reduction for the commercial and industrial areas.

- Upgrade the 525 mm trunk in Crossroads North Phase 1 in approximately ten years on the basis of a flow reduction for the commercial and industrial areas.
- Construct the Lakeside trunk sewer in approximately five years on the basis of a flow reduction for the commercial and industrial areas.
- Construct a regional lift station to consolidate the existing Lift Station #1, #2, and #3 in 2007.
- Upgrade the existing forcemain on 100 Avenue in 2006.

The estimated construction costs for each growth scenario are shown in Table 9.2.6.1.

Interim servicing was considered in areas including 116 Street North and South, Balisky Hodges, Lakeside, West edge of Crossroads South Phase 1 and SE ¼ Sec 6-72-5-6 and North Grande Prairie.

Benchmark Information

An investigation of the use of offsite levies to finance water and wastewater infrastructure was carried out for six municipalities including Lakeland County, Parkland County, Yellowhead County, Leduc County, Red Deer County and Municipality of Wood Buffalo. The methodology each municipality uses to calculate offsite levies varies. Also, the types of infrastructure recovered through offsite levies vary. Four of the municipalities calculate rates on a modified net area basis and two on a per lot basis.

Funding Mechanism

There are three funding programs that provide assistance to rural municipal water and wastewater infrastructure. These include New Deal For Cities and Communities (NDCC), Alberta Municipal Infrastructure Program (AMIP) and the Alberta Municipal Water/Wastewater Partnership.

Conclusions

The report has the following conclusions:

- Design criteria for three new types of land use including heavy industrial, general commercial and school were proposed. These new design criteria will enhance the design of the wastewater collection and disposal systems.
- The per capita wastewater flow was determined using three months of water billing records in the spring. Although the wastewater flow is generally lower than the water demand, it was proposed that the per capita wastewater flow to be 275 L/cap/day which is identical to the per capita water demand for the following reasons:
 - The water records in the spring which were used to determine the per capita flow do not include water used for miscellaneous purposes like watering lawns, cleaning streets or flushing fire hydrants and so on. Based on the available data, the estimated per capita flow is approximately 266 L/capita/day. Generally, the wastewater flow in summer will be slightly higher than the wastewater flow in the spring. Since no flow monitoring data is available for the assessment and the current design standards per capital wastewater flow of 275 L/capita/day appears to be working very well for the design of the wastewater system, the current per capita wastewater flow which is equivalent to the current per capita water demand was adopted. The design criteria for the per capita wastewater flow can be re-assessed and adjusted when flow monitoring data is available.

- The higher per capita wastewater flow can be considered to provide the wastewater system with a higher factor of safety. Also, if the actual flow is less than the design flow, the wastewater system will provide a longer service life.
- Among all options for the disposal of wastewater from the lagoon, discharging the effluent into the future City of Grande Prairie 116 Street sanitary trunk sewer is the preferred option. This option will require upgrading the existing Aquatera Wastewater Treatment Plant to accept the flow from the study area. A feasibility study to determine the upgrading requirements and the associated upgrading costs should be carried out prior to implementing this option.
- The servicing options for the study areas are discussed in Section 8.0 and was developed taking due consideration of the constraints in topography and the layout of developments and the servicing concept as shown in the proposed Area Structure Plans. The design of the upgrading of the Crossroads North trunk, Lakeside Trunk and the North regional Lift Station and the Regional Forcemain should be evaluated prior to finalizing the ultimate servicing options for the drainage areas.
- Since the commercial and industrial developments in the study area have large size of lots and the use of some of the lots may have a very small flow, a flow monitoring program should be implemented to assess the upgrading requirements of the trunk sewers and update the proposed staging and interim servicing plan.
- The Master Plan is conceptual in nature and based on the best information available at the time of the study in 2005. As a result, a more detailed study may be required prior to the implementation of the recommendations.
- This Master Plan should be updated every 5 years in accordance with the new information and growth potential.

Recommendations

The study has the following recommendations:

- Adopt the proposed design criteria as the County of Grande Prairie design standards
- Upgrade the existing lagoon immediately and conduct an investigation to select the most favourable disposal option
- The design of the Regional Lift Station (#8) and forcemain should be carried out as soon as possible.
- Implement a flow monitoring program to continuously assess and update the upgrading requirements.